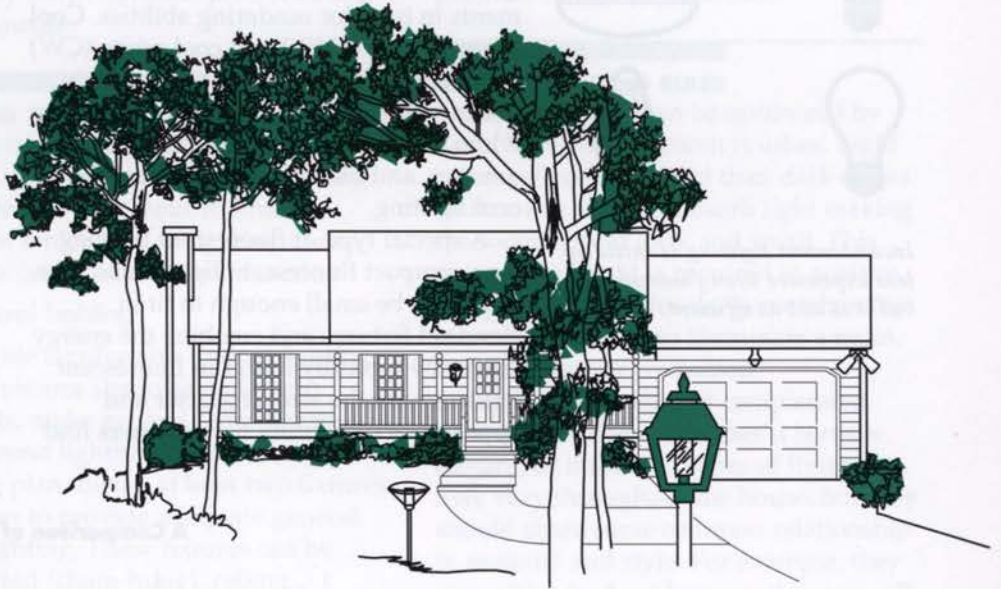


Lighting



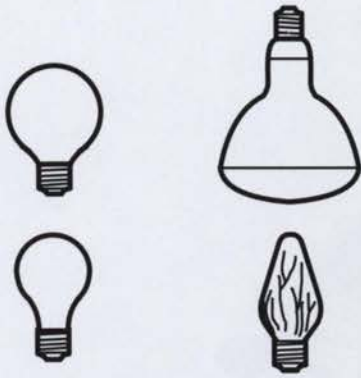
Council Note G4.1

School of
Architecture

Building Research Council

College of Fine and Applied Arts
University of Illinois at Urbana-Champaign

Good lighting can make your home more attractive and add to the enjoyment of personal and family activities.



Incandescent lighting is initially less expensive than fluorescent, but it is not as efficient.

GENERAL INFORMATION

Well designed lighting enhances any home. Energy-efficient lighting reduces the cost of home ownership. The following will help you understand some important aspects of lighting.

Energy-efficient fluorescent and incandescent lighting are the most common types of lighting used in homes today. Because of advances in technology, consumers have a wide variety of light fixtures and bulb types from which to choose. Incandescent lighting, which enhances oranges, reds, and pinks, is the most popular type of lighting because of its perceived warmth.

Fluorescent lighting, however, is gaining in popularity due to improvements in its color rendering abilities. Cool white deluxe (CWX) and cool white (CW) bulbs enhance blue and green tones. Warm white deluxe (WWX) and warm white (WW) bulbs enhance reds and oranges, and blend well with incandescent lighting.

A special type of fluorescent lighting uses compact fluorescent light bulbs. The bulbs can be small enough to fit in standard fixtures and combine the energy efficiency typically found in fluorescent fixtures with the size, character and appearance of lighting homeowners find

attractive. A 2700K bulb renders the same appearance of warmth and comfort as an incandescent (warm white). A 3500K bulb provides a neutral white light, and a 4100K bulb gives the room a cool glow (cool white).

Compact fluorescent bulbs can be used in living-, bed-, and bathrooms as well as in kitchen, utility, garage and outdoor spaces. They work well for task lighting, under-cabinet lighting, general down-lighting, landscaping and security lighting. As with any conventional fluorescent bulb, a ballast is required for their operation. Ballasts may be integrated (come with the bulb) or installed separately. A variety exists, including normal power factor (NPF) reactor, high power factor (HPF) reactor, magnetic, electronic and dimming ballasts.

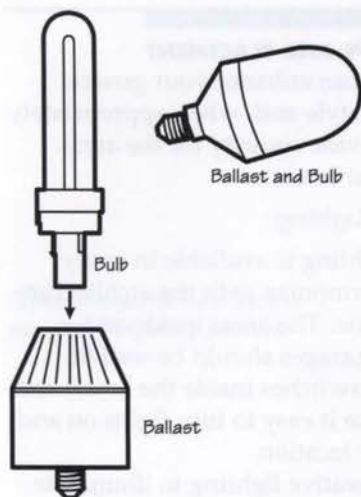
Electronic ballasts are quieter during operation than the magnetic type and are also instantaneous. They do not require a one to three second delay to "warm up" as do magnetic ballasts. Overheating, low light output and shortened bulb life can result if the bulb is improperly installed or matched with the wrong ballast.

Although compact fluorescent bulbs are more expensive, they use one-third to one-quarter of the amount of energy of incandescent bulbs to produce the same

A Comparison of Light Bulb Types

Bulb Characteristics	Incandescent Including Tungsten-Halogen	Fluorescent	Metal Halide	High - Pressure Sodium	Compact Fluorescent (Electronic Ballast)
Efficacy (lumens per watt) including ballast	13-24	63-95	69-115	51-130	55-60
Lumen Maintenance	Fair to Excellent	Fair to Excellent	Good	Excellent	Fair to Excellent
Color Rendition	Excellent	Good to Excellent	Very Good	Fair (Very Good)	Good to Excellent
Relight Time	Immediate	Immediate	10-20 Minutes	Less than 1 Minute	Less than 10 seconds
Comparative Fixture Cost	Low-simple fixtures	Moderate	High	High	Low-simple fixtures
Comparative Operating Cost	High-Short Life and Low Efficacy	Lower than incandescent	Lower than Fluorescent	Lowest of HID Types	Lower than Incandescent

The information contained in this publication was produced by the School of Architecture—Building Research Council (BRC) at the University of Illinois at Urbana-Champaign. For a set of 27 Council Notes for \$29.95 call 1-800-336-0616.



Screw-based compact fluorescent bulbs either have screw-in external ballasts or integral ballasts.

amount of light, and last up to ten times longer. The rated life span of compact fluorescent bulbs is anywhere from 9,000 to 20,000 hours compared to 750 to 2000 hours for incandescent bulbs.

Advantages of fluorescent bulbs, especially their extended life and low energy costs, make them well worth considering. One watt of compact fluorescent light provides the same illumination as 3 to 4 watts of incandescent light. The ballast adds 3 to 4 watts of energy usage. Therefore, a 17 watt (bulb @ 13 watts and ballast @ 4 watts) compact bulb is equivalent to a 40 to 60 watt incandescent bulb. The economy, energy efficiency and new design options provided by compact fluorescents generally outweigh their perceived cost disadvantage.

LIGHTING TYPES

General, accent, and task lighting, when combined, can fulfill the lighting requirements of all your rooms. The choice of which type of lighting to use depends on its location and function.

General Lighting

To provide comfortable overall lighting that eliminates shadows and sharp contrasts, make general room lighting, or background lighting, the basis of your lighting plan. Install at least two fixtures per room to provide adequate general room lighting. These fixtures can be suspended (chain-hung), ceiling mounted, recessed, or portable.

Task Lighting

Task lighting is more intense than general lighting because it is used when focusing on detail and sustained visual concentration is necessary. Study, kitchen, laundry, and craft areas require task lighting. A combination of task and general lighting in these rooms will help you avoid eye strain. Eyes tire quickly when frequent changes are made from brightly lit areas to dimly lit surroundings. Task lighting can be recessed, suspended, or portable.

Accent Lighting

The term "accent lighting" refers to concentrated beams of light used to add drama and highlights to a room. You can

visually enlarge an area of a room or show off art objects, book shelves, floral arrangements, furniture, and architectural detailing with accent lighting.

Accent lighting requires three times more light than general lighting. Recessed, adjustable spot or adjustable track lighting, incandescent bulbs (standard, R, or ER types) or low voltage bulbs (MR series) can provide accent lighting.

It is important to avoid glare when using this higher than normal lighting level. Check each fixture for maximum bulb size. Installing a higher wattage light bulb than specified will shorten the bulb's life and may cause a fire in recessed lighting if insulation has been placed too close to the fixture.

GENERAL LIGHTING RULES

Reflected light can be optimized by using light-colored room finishes. Light colors reflect more light than dark colors. Dark matte surfaces absorb light making the room appear dark and small. This means more light is required to achieve adequate lighting levels. Remember, the more light needed to illuminate a room, the more energy consumed.

Light fixtures should complement your home's decor, whether it is rustic, elegant, or informal. Types of fixtures may vary throughout the house, but they should share some common relationship in material and style. For example, they may all be made of brass or they may all be contemporary in style.

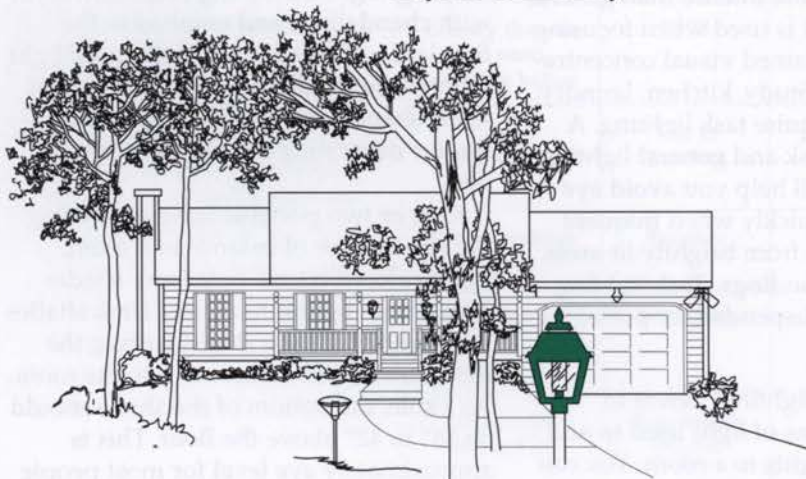
Lighting can create focal points. You may highlight the dining room and foyer with chandeliers, and emphasize the fireplace with wall sconces. Because light fixtures are available in a wide range of sizes, shapes, and finishes, the possibilities for decorating with light are unlimited.

One or two portable lamps can bring the appearance of balance to a room. Light colored translucent lamp shades allow more light into rooms. Dark shades trap light inside the shade, forcing the light down rather than out into the room. As a rule, the bottom of the shade should be 38" to 42" above the floor. This is approximately eye level for most people



Motion sensors light the way for your guests. Place light fixtures on both sides of the front door to eliminate shadows, and make it easier to see your visitors.

Many options exist for outdoor lighting. High Pressure Sodium and Metal Halide fixtures are available to provide security and decorative lighting.



when they are seated. For optimal visual ease, lamps should be placed to the side and slightly behind chairs and sofas, and to the side and slightly in front of desks.

Dimmer switches, three-way bulbs, photocell, remote-control, and timer switches control the light output of fixtures. Dimmer switches can change the lighting level of fixtures. **These switches should not be used to control fixtures containing compact fluorescent bulbs because doing so may create a fire hazard.** Multiple-light-level bulbs provide three different light levels in one bulb (50, 100, and 150 watts, for example). These bulbs allow you to increase or decrease the light output to suit your activities. If general room lighting is desired, the first level, 50 watts, is appropriate. Activities such as sewing and reading require 100 or 150 watt levels.

Photocells are sensitive to light quantities and are used inside homes in night lights, for example, and outside homes in fixtures for dusk to dawn lighting and walkway and driveway illumination.

Fluorescent Disposal

All fluorescent lights contain a small amount of mercury, a hazardous material. Some magnetic ballasts contain small amounts of other hazardous materials. For these reasons, fluorescent lamps and ballasts should not be discarded with the trash. These hazardous materials should be taken to a hazardous waste site, or collected appropriately. Check with recycling and hazardous waste agencies in your community.

FIXTURE TYPE AND PLACEMENT

Fixtures can enhance your general decorating style and, when appropriately placed, provide security for the areas around your home.

Exterior Lighting

Exterior lighting is available in many styles to harmonize with the architecture of your home. The areas inside and outside of garages should be well lit. Three-way switches inside the house and garage make it easy to turn lights on and off at either location.

Use decorative lighting to illuminate steps, sidewalks, door sills, and patios. Lower light levels and adequately shielded bulbs prevent glare. Eyes that have adapted to the dark can be temporarily blinded by high light levels.

Decorative fixtures at all exterior doors add beauty and allow visitors to be identified easily. The bulbs in these fixtures should be adequately shielded to prevent visitors from being blinded by glare. For entrance illumination, install a light fixture on each side of the front door instead of overhead. Overhead lighting creates shadows and can make it difficult to identify visitors.

Most homes have dark areas around the house that require some form of lighting. General area lighting (flood lights) located on the house, poles, or trees provides safety and extends the time individuals and families can engage in outdoor activities.

Remote-control timer switches turn lights on and off at designated times such as at dusk, dawn, or before family members return home from work and school. Timers can be used as security devices when you are on vacation so that your house looks occupied. Motion sensors can light approaches to the house. Low wattage high pressure sodium (HPS) or Metal Halide (MH) fixtures can deliver energy efficient light to these outdoor areas. Aiming flood lights at a 45° downward angle will minimize glare. Flood lights can be tucked under the eaves out of the line of sight.

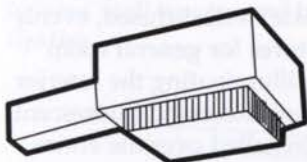
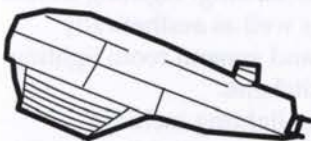
In the summer, insects are attracted to outside lights. Locating flood lights away from doorways will reduce this nuisance.

Living rooms should have a variety of lighting sources.



Entrance/Foyer Lighting

The foyer is the first place guests will see so lighting in this area should be warm and inviting. The foyer light fixture can be ceiling mounted or suspended, ornate or simple. Care should be taken in selecting a fixture that is in scale with the surroundings and does not overpower the entrance.



High Pressure Sodium and Metal Halide lighting fixtures are efficient ways to light the outside of your house.

Hallway and Stair Lighting

Each hallway should have at least one light fixture. Long hallways and halls that turn a corner require more than one fixture. Three-way switches at both ends of a hall provide convenience.

A light fixture should be placed above the lower landing of the stairs to highlight the edge of the tread. Install the fixture close to the ceiling, or use a frosted bulb to decrease or eliminate glare that may interfere with a person's vision when he or she is at the top of the stairs.

Living Room and Family Room Lighting

Today living and family rooms are multi-purpose areas, often containing multi-media centers, computers, and game tables. They require flexible lighting for reading, watching TV, entertaining, and studying. To make these rooms optimally useful and inviting, a full range of light is needed—task, accent, and general room lighting.

Portable lamps can be used for soft general lighting, suspended fixtures over

work and game areas for task lighting, and recessed down lights or track lighting for accent lighting. Wiring the fixtures to separate switches makes it possible for specific lights to be turned on when needed. Dimmer switches allow lighting levels to be lowered for TV watching and computer use.

Bedroom Lighting

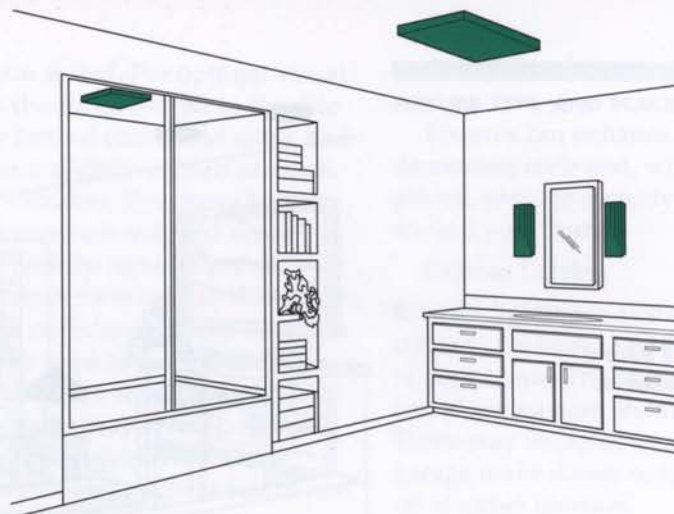
Bedrooms also require adjustable lighting levels. Use a ceiling mounted fixture or indirect lighting for general room lighting and a desk lamp or suspended fixture for task lighting. Multiple-light-level bulbs for desk lamps make it possible to change light levels to accommodate different activities.

Bathroom/Dressing Room Lighting

Today's bathrooms and dressing rooms are used for grooming, exercising, and relaxing. Bathroom and dressing room lighting requires flexibility. Two types of lighting can be found in bathrooms: general (area lighting) and mirror lighting. Select fixtures that can be located in a wet environment. All bathroom electrical outlets should be on a ground-fault circuit interrupter (GFCI). In shower and tub enclosures, fixtures should be approved for wet locations, be moisture resistant, and be protected by a GFCI.

Because today's bathrooms tend to be larger than older bathrooms, it is suggested that 75 watt bulbs be used for bath/shower and grooming areas.

Today's larger bathrooms require more flexible lighting.



General area lighting can be ceiling-mounted or recessed, either incandescent or fluorescent. Incandescent lighting blends well with warm white deluxe fluorescent bulbs. These fluorescent bulbs enhance skin tones, are energy efficient, and emit less heat than incandescent bulbs.

The most common fixture in the shower or bathtub is a recessed or ceiling-mounted incandescent fixture with a white diffuser. Again, in shower and tub enclosures, fixtures should be approved for wet locations, be moisture resistant, and be protected by a GFCI. For added comfort and moisture control, a combination ceiling exhaust fan and light can be installed.

Side lighting on both sides of the mirror provides even amounts of light for shaving or applying makeup. Either pendant or wall-mounted lighting (vertical strips or wall sconces) can be used. Center the light fixture at eye-level (approximately 62" to 64" above the floor) with a minimum of 60 watts of light and locate the fixtures approximately 30" apart. Remember, a 13 watt compact bulb (with ballast = 17 watts) is equivalent to a 40-60 watt incandescent bulb.

Always use frosted bulbs for mirror lighting. Frosted bulbs soften light; clear bulbs produce a harsh glare. Avoid over-the-mirror lighting because this can produce shadows around facial features. A dimmer switch for vanity lights will allow the light level to be adjusted for applying makeup, shaving, and other

uses. Remember, dimmer switches should not be installed to regulate compact fluorescent fixtures.

Light-colored finishes for the vanity top and surrounding walls allow light to reflect up off the vanity top to illuminate the user's neck and chin, and off surrounding walls to create an even wash of light around the face and head.

Kitchen Lighting

Kitchens are used for preparing food, studying and socializing. Lighting should be functional as well as aesthetically pleasing. Task and general room lighting is effective in kitchens.

General room lighting includes recessed or surface-mounted fluorescent or incandescent fixtures. It is important to use appropriate, well-diffused, evenly-spaced light fixtures for general room lighting and for illuminating the interior of kitchen cabinets. Recessed fluorescent fixtures can be installed over the entire ceiling for soft glowing general room lighting.

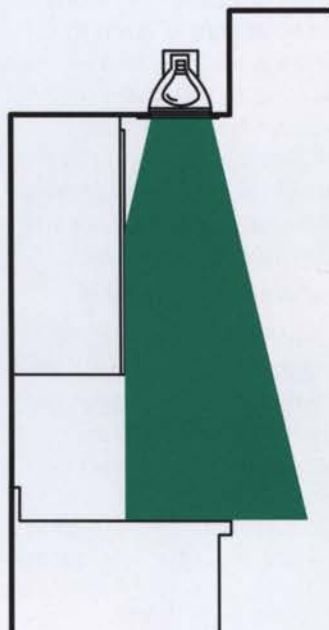
All work surfaces require some form of task lighting. Illuminate counter tops by installing under-the-cabinet fluorescent lighting which can be plugged into an outlet or installed permanently by an electrician. It is important to install fixtures over the sink, stove, and work islands as well.

Fixtures should be connected to separate switches so that general room lighting can be turned on separately from task lighting. The switches for the sink and stove lights should be separate. The



Illuminate counter tops with under-the-cabinet fluorescent lighting.

Can lights may be installed in the soffits for perimeter and task lighting.



A variety of fixtures in the dining room may include general lighting, wall sconces, and track lighting.



surface-mounted incandescent fixtures should be switched separately from the general lighting. Under-the-cabinet fluorescent or soffit "can" lighting may be used for perimeter or task illumination.

Lighting the dining counter or table visually separates it from the work areas of the kitchen. The light should be of low brightness and the beam spread should cover the entire table or counter. Remember to shield bulbs adequately to prevent glare. Light fixtures should be above the direct line of sight when one is seated.

Dining Room Lighting

The general height of the main source of light (pendant fixture or chandelier) should be 30" to 36" above the table and a minimum of 100 to 150 watts. Pendant fixtures come in a variety of sizes and styles. Choose a fixture that matches the style of the room as well as one that is in proportion to the dining area and the table. For example, if your dining room is 10' x 10', use a 17" to 20" diameter fixture. If your dining room is 12' x 12', use a 24" to 30" diameter fixture. Illuminate the perimeter of the room by installing wall sconces that match the pendant fixture.

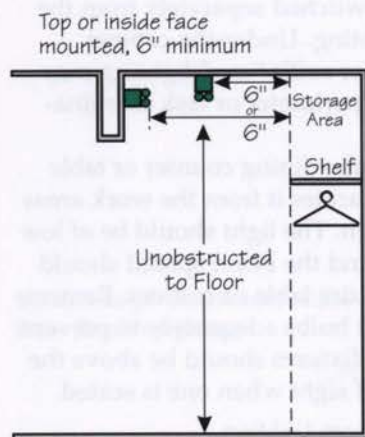
Additional light will be needed over a sideboard or serving table. Dimmer switches can control light output to suit dining occasions—bright, cheerful lighting for family gatherings or soft, intimate lighting for formal dinners.

Computer Lighting

Use indirect lighting in a computer room and reflect light off the ceiling to eliminate unwanted glare from the screen. Select either a floor lamp or a suspended fixture with indirect light, located to the side of the computer screen. A small task light will illuminate paperwork.

If the room has a window, either position the computer screen perpendicular to it or install drapes, or do both. A tilt-able screen can move the screen out of the direction of any glare. Nonreflective surface materials around the computer will also reduce glare.





Fluorescent lighting can be used in closets.

Closet Lighting

All household closets should have some form of lighting. This light can be "borrowed" light from the central room fixture, or light from an installed fixture. A bare incandescent bulb should never be installed in a closet, and due to clearance requirements most closets will not be able to accommodate an incandescent fixture. Incandescent bulbs emit heat and could cause a fire if they are installed too close to boxes or clothes. A fluorescent light must be at least 6" from the shelves and clothes, and the area beneath it must also be clear to the floor.

A walk-in closet is most effectively illuminated by placing the fixture in the center of the traffic area. A small battery operated light fixture near the floor will illuminate shoes and other objects.

Utility Room/Workshop Lighting

Utility rooms and workshops require general lighting and task lighting. Either fluorescent or incandescent fixtures can be used for general lighting. Locate additional fixtures over specific work areas: workbenches, washers, dryers, ironing boards. Adequate lighting levels are more important than the color of the light.

Garages

Garage lighting should be installed to allow illumination of the areas where people will be getting into or out of cars. Placing lights directly over a car will cast shadows where people will be walking.

Try to locate lights near each side of the car, between autos in multiple vehicle garages, and in front and back of cars. A GFCI receptacle should be installed so that a trouble light can be used for repair and maintenance work.

Daylight

Windows and skylights bring natural light inside the home. Combining interior lighting with natural lighting enhances bathrooms, bedrooms, living rooms, hallways, and may lower your energy bill. White translucent material in skylights soften and filter natural light. Ultraviolet filters help prevent the sun from slowly rotting or bleaching natural materials. For information on window planning refer to Council Notes: Window Planning Principles (F11.0) or Speaking of Windows (Technical Note 16).

Lighting should be efficient, versatile, and enhance your living environment. The lighting effect you want can be created with a little bit of information and imagination.

Remember to do the following when designing with light:

- ▲ Determine the correct amount of light required.
- ▲ Choose the appropriate light bulb for the job.
- ▲ Choose the appropriate light fixture to house the bulb.
- ▲ Coordinate lighting equipment, the room, and the illuminated object.

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